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(71) Applicant: **L.M. del F.lli Monticelli S.r.l.**
60027 Osimo (Ancona) (IT)

(72) Inventor: **Monticelli, Domenico**
60027 Osimo (Ancona) (IT)

(74) Representative: **Lanzoni, Luciano**
c/o BUGNION S.p.A.
Via Cairoli, 107
47900 Rimini (Forli) (IT)

(54) Square for the structural connection of metallic tubular section bars contained for reinforcement purposes inside plastic tubular section bars and method for its mounting

(57) A square for the structural connection of metallic section bars (2m) contained for reinforcement purposes inside plastic tubular section bars (2p), comprises a pair of connecting elements (3) having a body (4) that can be coupled in prismatic fashion with an inner cavity (7) of the metallic section bars (2m), in such a way as to be able to translate longitudinally therein; and having heads (5), monolithic with the body (4), so shaped as to be coupled in mutual abutment and in abutment with walls (20) of the plastic section bars (2p). The connecting elements (3), made of metallic material, have projections (6) and cavities (7) counter-shaped in complementary fashion and able to penetrate each other and connecting means (10), able to maintain the heads (5) mutually connected in at least a predetermined condition of tightening after the welding of the plastic tubular section bars (2p). A method of mounting forms an integral part of the invention.

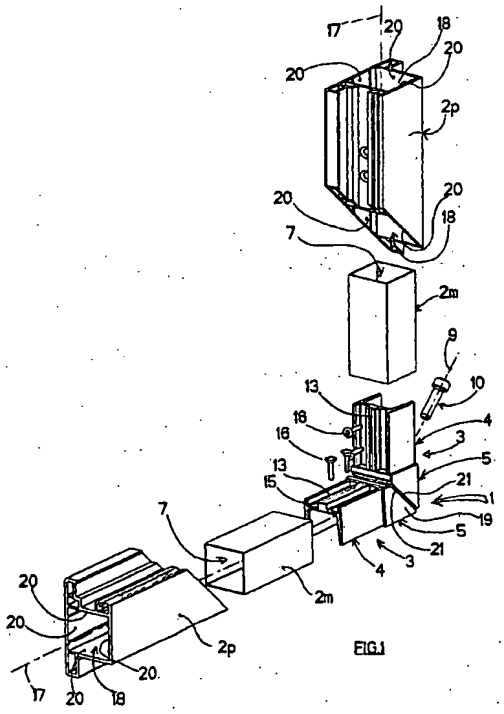

FIG.1

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Description

[0001] The present invention relates to the fabrication of plastic frames for windows and doors and in particular it concerns a square for the structural connection of metallic tubular section bars contained, for reinforcement purposes, inside plastic tubular section bars.

[0002] For the fabrication of window and door frames made of plastic material, the prior art provides for the use of extruded tubular section bars made of polyvinylchloride (PVC) which: are cut to measure; butted at the ends with an oblique cut, appropriately inclined, and permanently joined to each other by means of a head-to-head weld executed with localised thermal softening of the section bars, with their compression in mutual abutment and with the cooling and solidification of the junction area.

[0003] The frames thus formed are then subjected to milling operations to remove the projecting parts of the beads due to the plastic sliding of the softened material and determined by the upsetting that results from the mutual compression of the section bars.

[0004] PVC section bars generally have fairly modest mechanical strength and rigidity, compared with the analogous characteristics of the metallic section bars employed to manufacture windows and doors. This can cause, under the different conditions of use of the frame, such distortions and expansions as to prevent the correct closure of the window or door and/or as to prevent the regular mobility of the mechanisms for operating the handles, the locks and the opening and closing devices with which the window or door is normally fitted.

[0005] Therefore, in the construction of plastic windows and doors of better technical quality and/or of medium or large size, a common practice is to reinforce the plastic section bars made of PVC from their interior by introducing therein, prior to welding, strong steel tubular section bars.

[0006] Tubular section bars made of steel have considerably smaller length than the members (uprights and cross members) of the frames that house them. Their length cannot be such as to reach the welded area of the plastic section bars, or it would be impossible for the machines that weld the plastic profiles to operate correctly. The welding machines use special welding blades which, by interposing themselves between the heads of the section bars to be connected, heat the their edges to be joined; and which then retract from the junction area to allow the section bar heads to be subsequently approached to each other and joined.

[0007] The correct mobility of the blades, which are powered electrically, therefore requires the absolute certainty that the blades do not interfere either mechanically or electrically with the metallic tubular elements.

[0008] However, the junction areas of the frames of the windows and doors thereby obtained, lacking internal reinforcement, continue to be structurally critical for the entire window or door. Their critical nature is further enhanced by the fact that the weld notoriously modifies the crystal structure of the plastic material making it more fragile and more susceptible than others to undergo a more rapid structural degradation when the window or door is in use and by the fact that the metallic tubular elements on the other hand provide no contribution to the reduction of the drawbacks caused by this phenomenon.

[0009] To attempt to remedy this situation, a known constructive technique provides for introducing connecting squares made of plastic material into the junction area of the section bars.

[0010] These squares essentially comprise a pair of distinct connecting elements, having a body that can be coupled in prismatic fashion with the inner cavity of the metallic section bars in such a way as to be able to translate longitudinally therein, and having heads, monolithic with the body, so shaped as to project from an end of the tubular body and to be coupled in frontal abutment with each other and in lateral abutment with the walls of the plastic section bars.

[0011] The abutted coupling of the heads that determines their connection inside the connecting area of the section bars is obtained, in this case as well, by welding and with the intervention of the welding blade, which allows to connect the plastic section bars head to head.

[0012] Such a solution entails an increase in the extension of the welding surface which, no longer limited only to the thickness of the walls of the plastic tubular section bars, in this case also involves also the surface of the mutually opposite faces of the heads, brought in mutual contact.

[0013] The increase in strength and rigidity of the frame of the window or door in the connecting area deriving from the geometric filling of the inner cavity of the plastic section bars and from the greater extension of the adhesion surface induced by the presence of the plastic square, though beneficial, is nonetheless quite modest.

[0014] The strength of the connection is left, in this case as well, solely to the weld and this entails the persistence of all the drawbacks linked to the crystallisation, fragility and rapid deterioration phenomena that are typical of welded connections.

[0015] Moreover, even when using connecting means whereby the bodies of the connecting elements of the square are made to expand inside the cavity of the metallic tubular section bars in such a way as to obtain a sort of their anchorage by interference, the connecting elements always maintain a more or less accentuated freedom to slide relative to the metallic tubular element.

[0016] Such freedom limits the increase in strength and structural rigidity of the assembly which the frame of the window or door can actually receive and offers no practical strength contribution to the welds of the plastic section bars that still continue to be the most stressed parts of the window or door in the various conditions of use.

[0017] The aim of the present invention is to overcome the aforementioned drawbacks by means of a metallic square that is able to connect the metallic tubular section bars in such a way as to allow to create after the weld of the plastic section bars and also inside their angular junction area, an uninterrupted metallic structure able to provide the window or door as a whole with the strength and rigidity required for its optimal functionality, independently from the strength and rigidity contribution offered by the external plastic section bars.

[0018] In accordance with the invention, this aim is fully achieved by a square for the structural connection of tubular metallic section bars contained for reinforcement purposes inside plastic tubular section bars mutually welded head to head, comprising a pair of distinct connecting elements, having a body that is able to coupled in prismatic fashion with an inner cavity of the metallic section bars in such a way as to be able to be translated longitudinally therein and having heads, monolithic with the body, so shaped as to be able to couple in mutual abutment in correspondence with a junction plane and in abutment with walls of the plastic section bars, characterised in that said connecting elements are made of metallic material and have projections and cavities that are counter shaped in complementary fashion obtained in their heads and able mutually to fit inside each other according to a sense of travel of a transverse direction to the junction plane of the section bars; connecting means, able to be activated through a wall opening of the plastic section bars and after the welding of the plastic section bars, being provided to oppose the disengagement of the projections and of the cavities in the other sense of said direction of motion, thereby maintaining said mutually connected heads in at least a predetermined condition of tightening.

[0019] The technical characteristics of the invention, according to the aforesaid aims, can clearly be noted from the content of the claims set out below and its advantages shall become more readily apparent in the detailed description that follows, made with reference to the accompanying drawings, which represent an embodiment provided purely by way of non limiting example, in which:

- figure 1 is an exploded perspective view of an angular connection of a detail of a window or door frame that employs a square according to the invention;
- figures 2, 3 and 4 are respectively a front view and two lateral view of the connecting square according to the invention;
- figures 5A and 5B are axonometric global representations of the square seen from two opposite observation points;
- figures 6, 7 and 8 are section views of a detail of a window or door, illustrating the progression of steps through which the square is mounted inside a plastic window or door;
- figures 9, 10 and 11 are respectively a front view and two side views of a second alternative embodiment of the square;
- figure 12 is an axonometric global view of the square of figures 9, 10 and 11;
- figures 13 and 14 are a front section view and a lateral view of a structural connection joint obtained by means of the square of figures 9 through 12.

[0020] In figure 1 of the accompanying drawings, the reference 1 globally indicates a square for the structural connection of metallic tubular section bars 2m, with quadrangular contour, contained for reinforcement purposes inside plastic tubular section bars 2p, preferably made of polyvinylchloride (PVC) and destined to be mutually welded head to head in forming angular connections of generic window or door frames.

[0021] The square 1 essentially comprises a pair of distinct connecting elements, indicated as 3, which are mutually connected by a screw 10 and which are then connected with the metallic section bars 2m and plastic section bars 2p of the window or door frame.

[0022] The connecting elements 3, wholly metallic, comprise in particular a monolithic body 4 and a head 5.

[0023] The body 4 has substantially quadrilateral contour and it is provided with a longitudinal groove 13 delimited by parallel bent edges 15, projecting from a lateral wall of the body 4.

[0024] The edges 15 are opposed to equidistant undulated faces whose curvilinear development is generated by envelopment lines of circle arcs complementary to the contour of screws for anchoring the square 1 to the metallic section bars 2m and plastic section bars 2p, indicated as 16.

[0025] The body 4 is destined to be inserted in the internal cavity 7 of a corresponding metallic tubular section bar 2m and to be coupled in prismatic fashion therewith in such a way as to maintain the freedom to translate in guided fashion along a direction 17 substantially longitudinal to the section bar 2m that houses it.

[0026] The heads 5 have quadrilateral contour defined by four plane squares 19, mutually orthogonal and having different superficial extension.

[0027] The contour of the heads 5 has a greater extension than the corresponding contour of the body 4, so that when the body 4 is inserted in the cavity 7 of the metallic section bar 2m whereto it is destined, the heads 5 project totally outside the metallic section bar 2m.

[0028] The quadrilateral contour of the heads 5 is instead strictly complementary to the interior contour of the inner cavities 18 of the plastic section bars 2p.

[0029] The heads 5 can therefore be contained in said cavities 18 in centred conditions and with parallelism of their own peripheral faces 19 and of mutually opposite inner walls 20 of the plastic section bars 2p.

[0030] By effect of the dimensional and shape relationships described above, the heads 5 are able to be coupled in abutment with the walls 20 of the plastic sec-

tion bars 2 with the possibility to translate, longitudinally to the section bars 2p and in guided fashion along the walls 20, in the direction 17 of each of the section bars 2p constituting the members of the window or door.

[0031] The heads 5 also have inclined faces 21, which can be associated in contact and in mutual opposition and are able to define an interposed junction plane 8 of the connecting elements 3 of the square 1; junction plane 8 that is preferably oriented according to the bisecting line of the angle of connection of two contiguous members of the window or door.

[0032] The inclined faces 21 are also traversed by holes 11 [visible for instance in figure 6] having their axis substantially orthogonal to the junction plane 8.

[0033] Figures 2, 3, 4, 5A and 5B also show that the heads 5 are provided with projections 6 and cavities 7 counter-shaped in complementary fashion and alternatively positioned on the faces 21. The projections 6 and the cavities 7, which preferably have pyramid frustum shape, are such as to mutually fit into each other in orderly fashion when the heads 5 are approached to the junction plane 8, i.e. when the heads 5 are moved towards each other in accordance with one of the senses of travel of a direction 9 transverse to the junction plane 8 of the section bars 2m; 2p, direction 9 which practically coincides with the axis of the screw 10.

[0034] When the heads 5 are associated in a condition of mutual abutment of their inclined faces 21 and with the penetration of the cavities 7 by the projections 6, the two connecting elements 3 come to realise, in combination with each other and with the screw 10 a so-called perfect spatial fit, albeit one that can be unmade.

[0035] The spatial fit coupling described above by virtue of the rigidity deriving from the shape of the square 1 and from the nature of the metallic material that composes it are such as favourably to condition overall geometry of the window or door. In other words, the shape of the window or door and the orientation of all the members composing it are subordinated to the geometric conditions imposed by the square 1 contained inside the welded junction of the plastic section bars 2p.

[0036] Figure 6 also shows that one of the heads 5 is provided, in correspondence with its inclined inner face 22, with a blade 12 that protrudes from said head 5 and projects towards the hole 11 in such a way as to intercept the trajectory of translation of the screw 10 when the screw, associated with the heads 5, reaches a first, well determined, condition of tightening with the heads 5. The transition towards a condition of further tightening is enabled by the bending of the blade 12 or also by its shearing by the head 5.

[0037] Figures 9, 10, 11 and 12 show a different embodiment of the square 1 in which the bodies 4 of the connecting elements 3 lack the indented seat 13 and are instead provided with push-buttons 14 [also visible in figure 13] housed in a seat 23 of the body 4 and contrasted by a spring 24 that constantly thrusts them towards the exterior of the body 4.

[0038] The mounting of the square 1, constructed in accordance with figure 1, can be described with the aid of figures 6, 7 and 8.

[0039] From said figures one can observe that before the execution of the head to head welding of the plastic tubular section bars 2p, the metallic section bars 2m are inserted inside the cavities 18 of the plastic tubular section bars 2p.

[0040] Subsequently, the connecting elements 3 of the square 1 are inserted, independently from each other, with their body 4 in the cavity 7 of the respective metallic section bars 2m and with the heads 5 projecting from said cavity 7 towards the junction plane 8.

[0041] The screw 10 is then introduced, through a wall opening 26, obtained in the plastic section bars 2p, in the holes 11 of the two heads 5.

[0042] During this operation, the insertion of the screw 10 brings the heads 5 to be positioned automatically at the same distance from the junction plane 5, whatever their primitive position along the direction 17.

[0043] After the insertion in the holes 11 the screw 10 is progressively tightened until a first condition of tightening of the heads 5, predetermined and corresponding to the reaching of the condition of abutment of the stem 27 of the screw 10 against the blade 12 [fig. 7].

[0044] The aforesaid operations are obviously facilitated by the freedom of the bodies 4 to translate longitudinally to the respective metallic tubular section bars 2m. At this point the screws 16, positioned on the plastic section bars 2p freely relative to the length of the bodies 4 of the connecting elements 3, are fully tightened traversing the walls of the plastic tubular section bars 2p and of the metallic section bars 2m and with subsequent engagement in the seat 13.

[0045] By means of the screws 16 and the seats 13, which embody a first form of anchoring means of the metallic tubular section bars 2m and of the connecting elements 3, the aforesaid operation results in making strictly integral with each other the connecting elements 3 and the respective plastic 2p and metallic 2m tubular section bars that contain them.

[0046] After this operation, the connecting screw 10 of the heads 5 is fully tightened against the resistance offered by the blade 12, which, behaving as a discriminator means between two different conditions of tightening of the screw 10, yields under the thrust of the screw 10 bending permanently or even detaching itself from the head 5.

[0047] The full tightening of the screw 10, i.e. of the connecting means it embodies, leads to exerting on the metallic tubular section bars 2m opposing traction forces, bilateral to the junction plane, which mutually concur in the junction plane 8, i.e. in the vertex of the window or door frame.

[0048] The square 1 enables not only the realisation, inside the junction area of the plastic section bars 2p, of the geometric conditions of perfect fit that assure the consequent geometric regularity of the window or door

frame, but also the continuous structural connection of the various metallic tubular section bars 2m. This allows to recreate, inside the window or door, an actual strong metal frame that runs uninterruptedly along the entire contour of the window or door.

[0049] The metallic frame thus formed provides the plastic window or door with adequate mechanical rigidity and strength for the most severe operating stresses of the window or door.

[0050] Moreover, the tensioning of the frame deriving from the full tightening of the screw 10 also allows considerably to reduce, if not totally to eliminate, the condition of internal stress on the head to head welds of the plastic tubular section bars 2p in correspondence with their permanent junction area whose material is more heavily tensioned. This allows ultimately to assure to the window or door the additional advantage of a longer duration of its working life.

[0051] In regard to the embodiment of the square 1 shown in figures 13 and 14, observing said figures it is readily apparent that the principle of operation of the square 1 remains identical to the one described above.

[0052] The fundamental difference in this case is represented by the embodiment of the anchoring means which, in this case, do not involve the plastic section bars 2p and which instead render mutually integral only the metallic tubular section bars 2m and the bodies 4 of the connecting elements 3; this integral condition obviously manifesting itself when the push-buttons 14 reach the condition of alignment with a corresponding opposite circular seat 25 obtained on the wall of the metallic section bar 2m, into which they snap under the thrust of the spring 24 located behind them.

[0053] The invention thus conceived can be subject to numerous modifications and variations, without thereby departing from the scope of the inventive concept. Moreover, all details can be replaced with technically equivalent elements.

Claims

1. Square for the structural connection of metallic tubular section bars (2m) contained for reinforcement purposes inside plastic tubular section bars (2p) welded to each other head to head, comprising a pair of distinct connecting elements (3), having a body (4) that can be coupled in prismatic fashion with an inner cavity (7) of the metallic section bars (2m) in such a way as to able to translate longitudinally therein and having heads (5), monolithic with the body (4), so shaped as to be coupled in mutual abutment in correspondence with a related junction plane (8) and in abutment with walls (20) of the plastic section bars (2p), **characterised in that** said connecting elements (3) are made of metallic material and have projections (6) and cavities (7) counter-shaped in mutually complementary fashion obtained in their own heads (5) and able to penetrate each other according to a sense of travel of a direction (9) transverse to the junction plane (8) of the section bars (2m; 2p); connecting means (10), able to be activated through an opening (26) of a wall of the plastic section bars (2p) and after the welding of the plastic section bars (2p), being provided to oppose the disengagement of the projections (6) and of the cavities (7) in the other one towards said direction (9) of motion, thereby maintaining said heads (5) connected to each other in at least a predetermined condition of tightening.

2. Square, as claimed in claim 1, **characterised in that** said connecting means comprise at least a screw (10) engaged in holes (11) obtained in said heads (5).

3. Square, as claimed in claim 2, **characterised in that** it comprises means (12) for discriminating the degree of tightening of the connecting means (10).

4. Square, as claimed in claim 3, **characterised in that** said discriminator means (12) are incorporated in one of said heads (5).

5. Square, as claimed in claim 4, **characterised in that** said discriminating means comprise at least a blade (12) that projects from said head (5) and that projects towards the hole (11) in such a way as to intercept the trajectory of advancement of the screw (10), the reaching of a first predetermined degree of tightening being indicated by the contact of said screw (10) with said blade (12), the subsequent full tightening of the screw (10) occurring with the corresponding yielding of said blade (12).

6. Square, as claimed in one of the previous claims, **characterised in that** it comprises anchoring means (16, 13; 14, 25) interacting between the bodies (4) of the connecting elements (3) and the metallic tubular section bars (2m) that house them in such a way as to inhibit the freedom of translation of the bodies (4) relative to the metallic tubular section bars (2m) that house them.

7. Square, as claimed in claim 6, **characterised in that** said anchoring means comprise at least a through seat (25) obtained in a wall of the metallic section bar (2m) and a push-button (14) borne by the body (4), elastically thrust towards said wall of the section bar (2m), said push-button (14) being able to engage in the seat (25) with thrusting motion upon reaching its own condition of alignment with the seat (25).

8. Square, as claimed in claim 6, **characterised in that** said anchoring means are able unitarily to en-

gage said body (4), said metallic tubular section bar (2m) and said plastic tubular section bar (2p).

9. Square, as claimed in claim 8, **characterised in that** said anchoring means comprise a seat (13) obtained in the body (4) of the connecting element (3) and at least a screw (16) able to be tightened with said seat (13) after traversing the walls of the plastic tubular section bar (2p) and of the metallic tubular section bar (2m).

10. Square, as claimed in claim 9, **characterised in that** said seat (13) has a prevalent dimension, oriented longitudinally to the metallic tubular section bar (2m).

11. Square, as claimed in claim 10, **characterised in that** said seat (13) has rectilinear edges (15).

12. Square, as claimed in claim 11, **characterised in that** said seat (13) has undulated edges (15), defined by envelopment lines of arcs of circle complementary to the contour of said one or each screw (16).

13. Method for the structural connection of metallic tubular section bars (2m) contained for reinforcement purposes inside plastic tubular section bars (2p) mutually welded head to head in correspondence with a junction plane (8) **characterised in that** it comprises the steps of:

- translating connecting elements (3), mounted able to translate in guided fashion in the metallic section bars (2m), until positioning their heads (5) in mutual abutment in correspondence with the junction of the plastic section bars (2p), said heads (5), in said condition of abutment, mutually penetrating their corresponding projections (6) and cavities (7) counter-shaped in mutually complementary fashion;
- activating, traversing a wall of the plastic section bars (2p), means (10) for the mutual connection of the heads (5) until reaching a first predetermined condition of tightening of the heads (5);
- making integral to the walls of the metallic tubular section bars (2m) at least bodies (4) of connecting elements (3) which are monolithic with the heads (5) and are contained inside the metallic section bars (2m);
- fully tightening said connecting means (10) in such a way as to exert, by means of connecting elements (3), corresponding tractions of the tubular section bars (2m), opposite relative to the junction plane (8).

14. Method, as claimed in claim 13, **characterised in that** said step of making integral the metallic tubular section bars (2m) and the bodies (4) of the connecting elements (3) also involves the walls of the plastic section bars (2p).

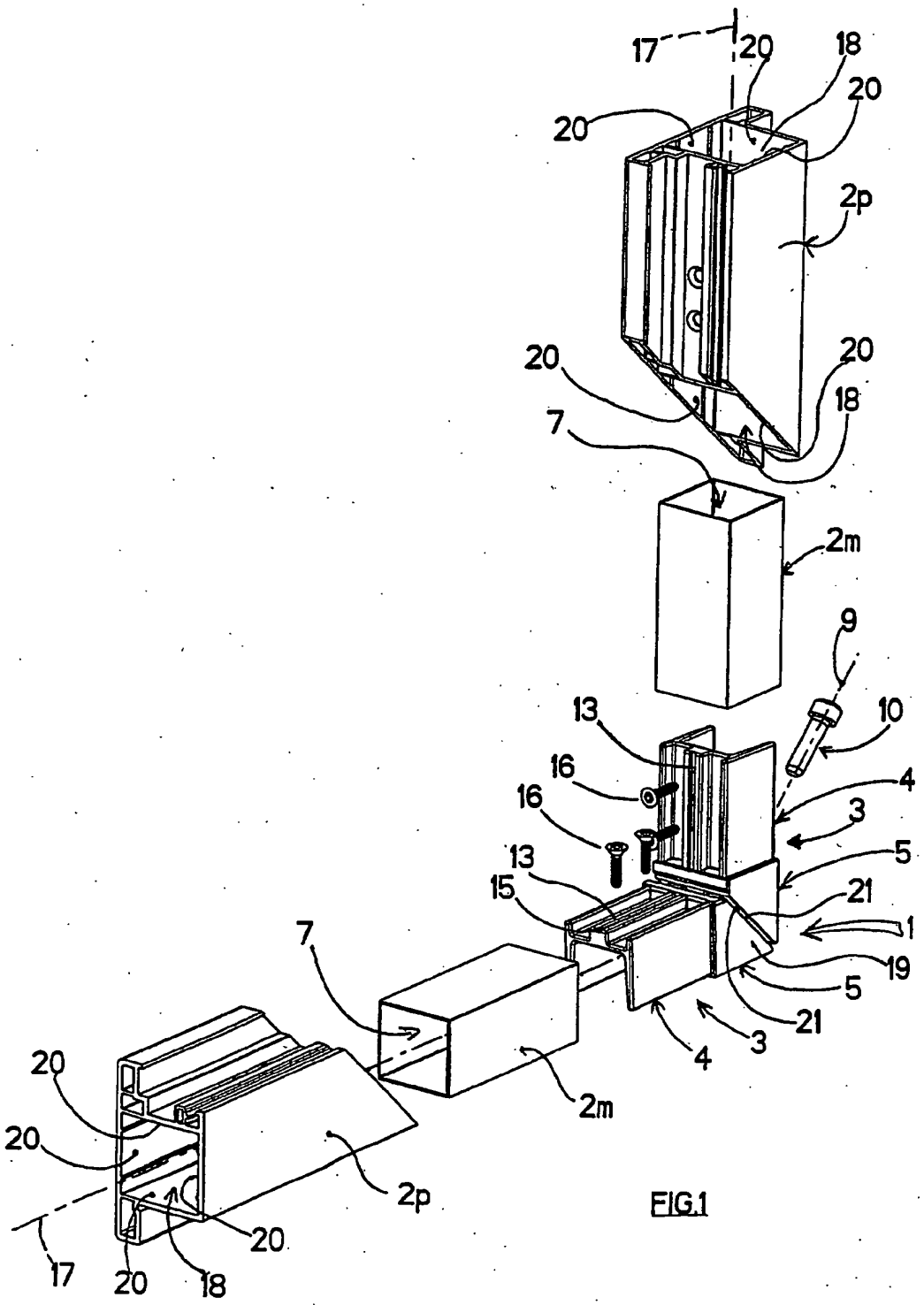
17
20
18
20
20
2p
20
20
18
7
2m
9
10
13
16
16
4
3
13
5
15
21
1
7
19
5
21
3
4
2m
20
20
2p
20
17
20
18

FIG.1

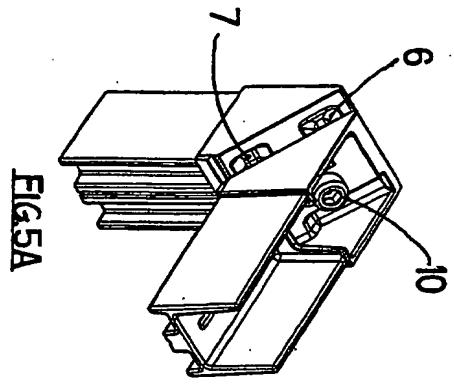

FIG.5A

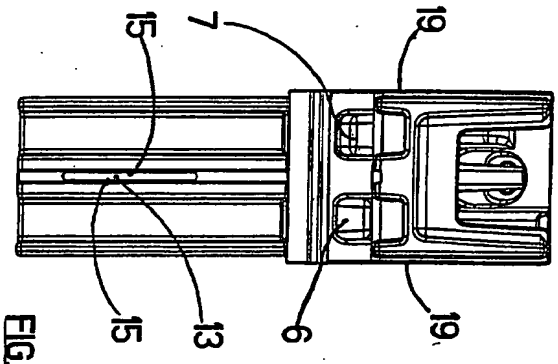

FIG.4

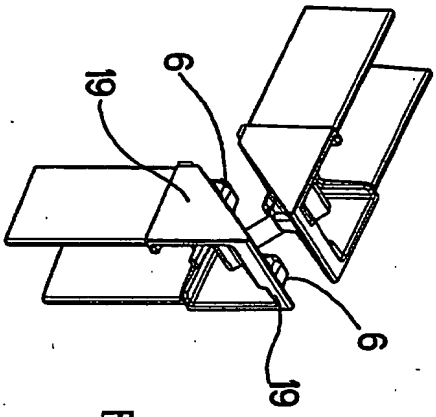

FIG.5B

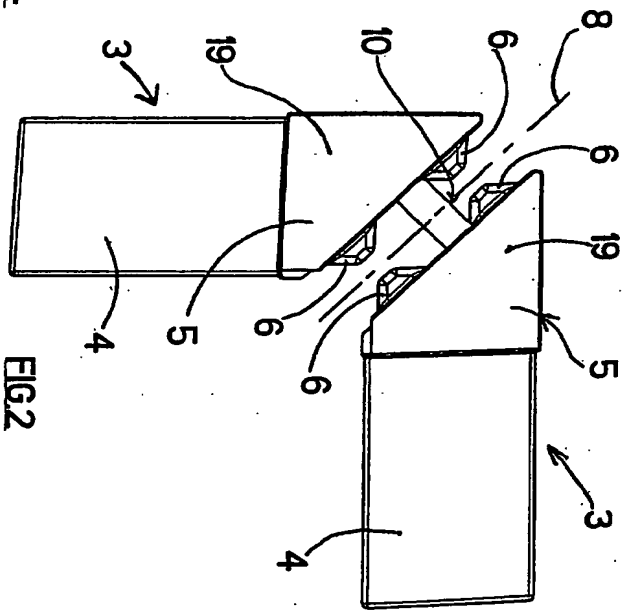

FIG.2

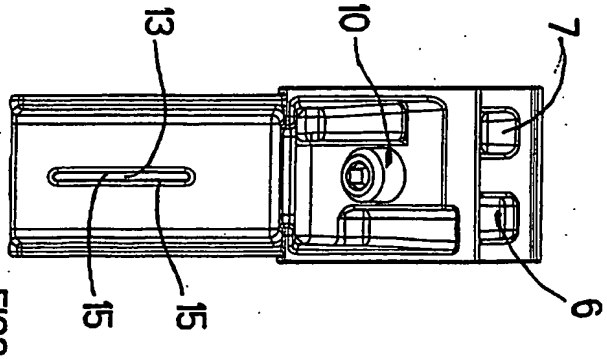

FIG3

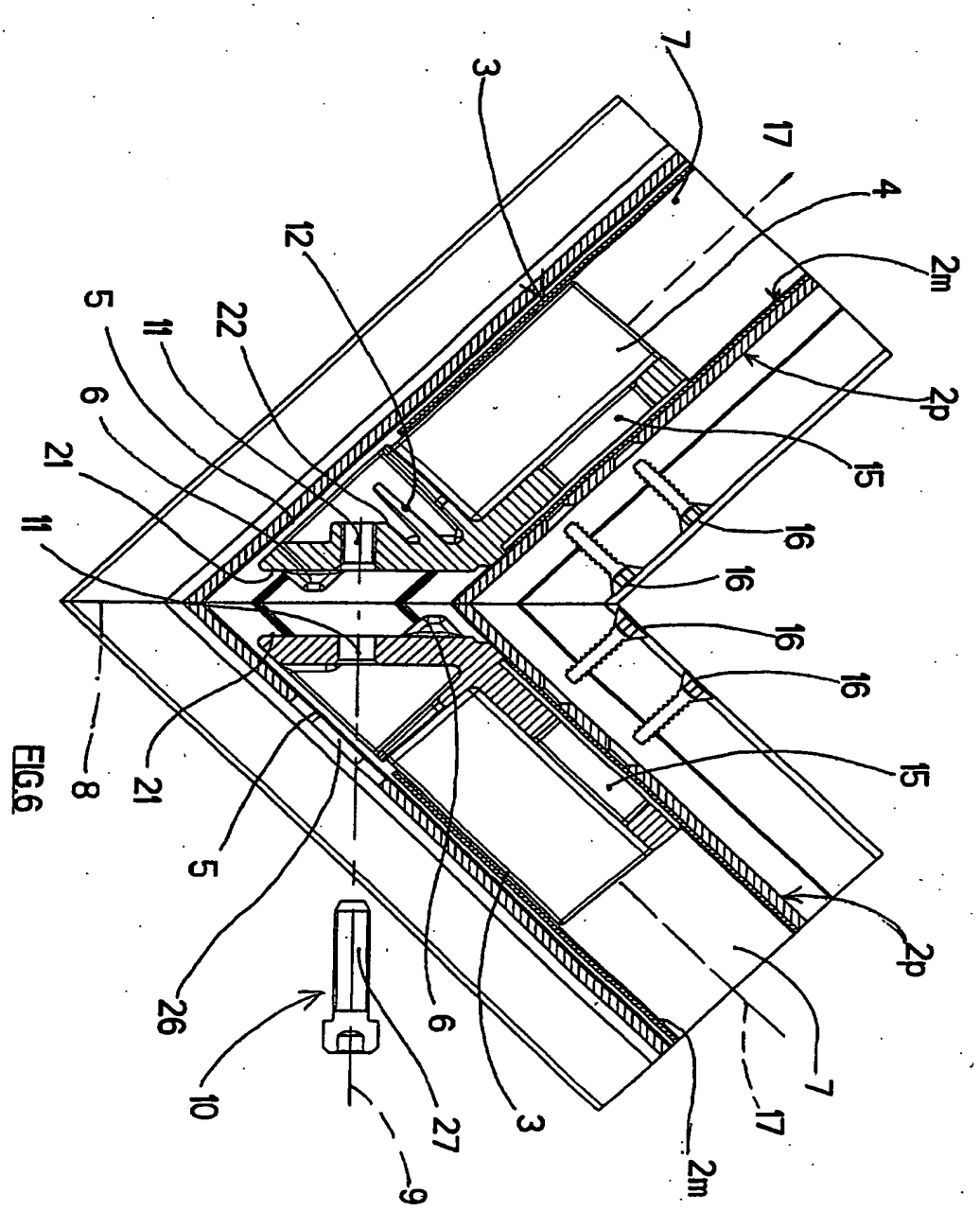
7
3
17
4
2m
12
2p
5
11
22
6
15
21
16
11
16
16
16
15
8
21
5
2p
26
6
7
10
27
3
17
9
2m

FIG.6

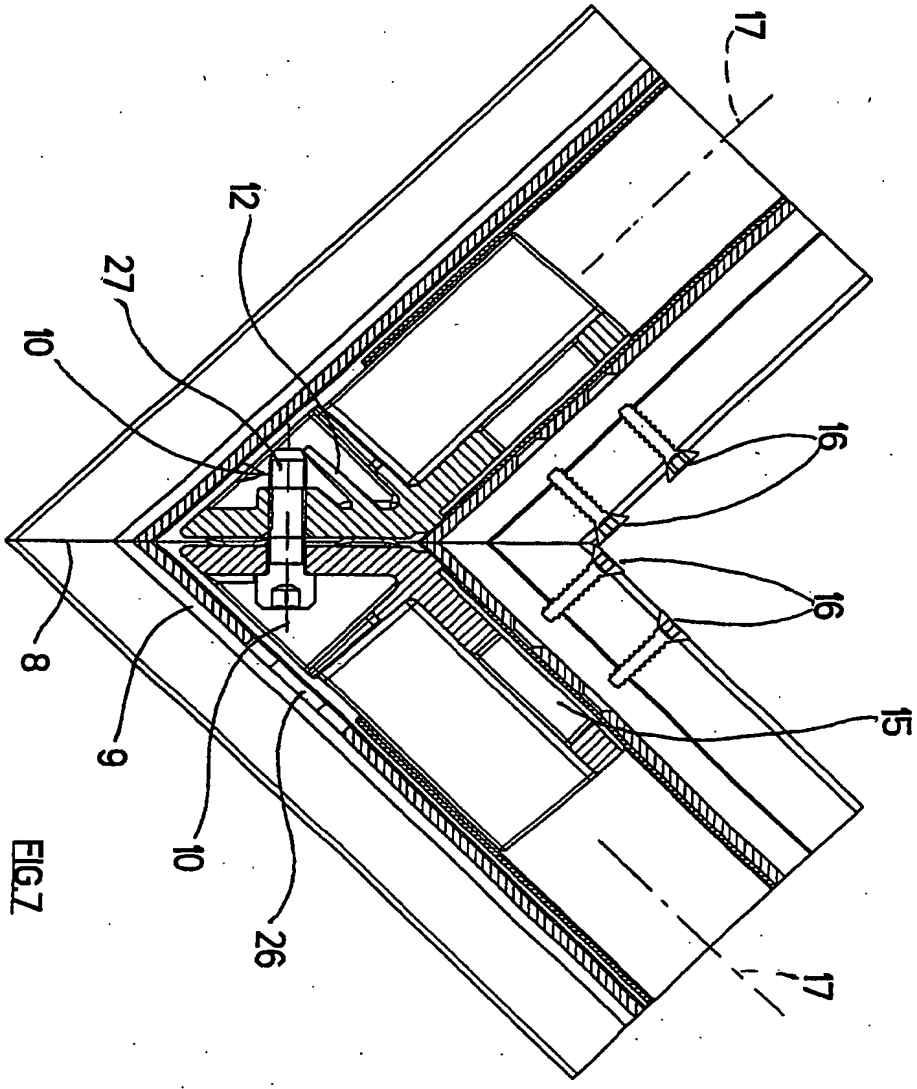

FIG.7

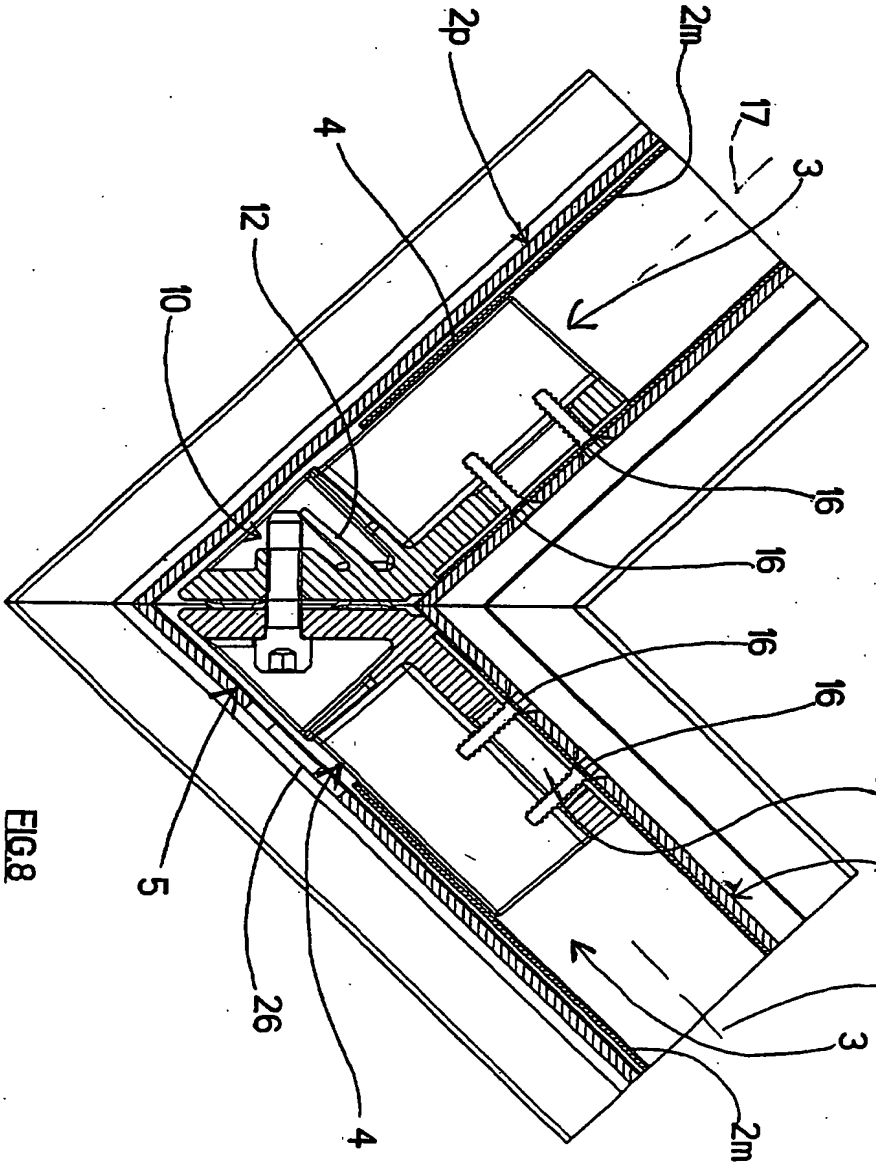

FIG.8

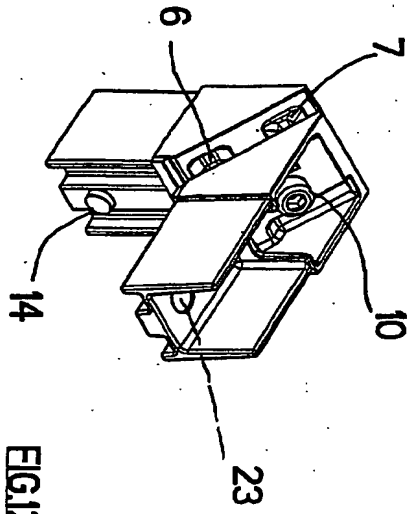

FIG.12

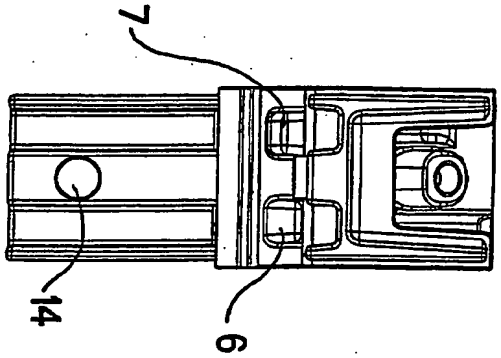

FIG.11

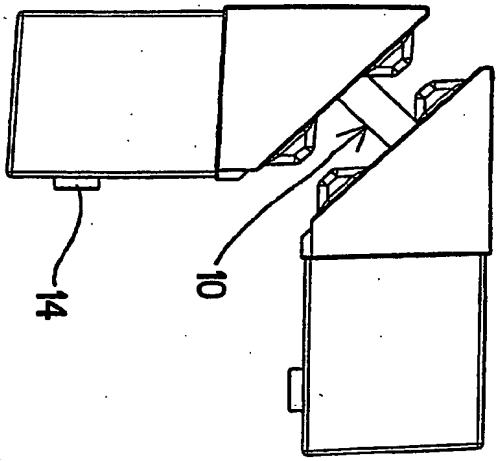

FIG.9

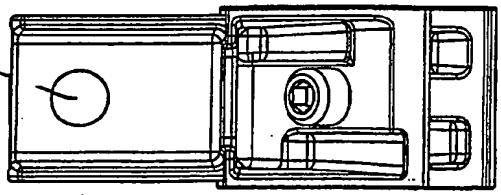

FIG10

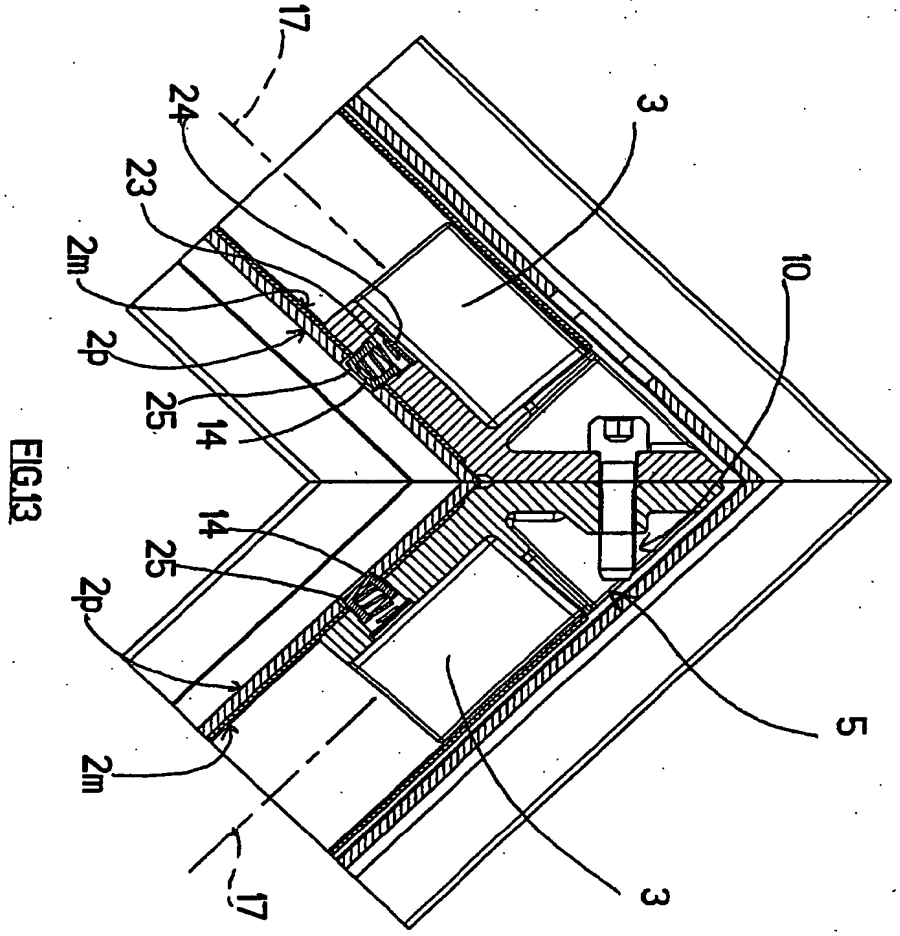

FIG.13

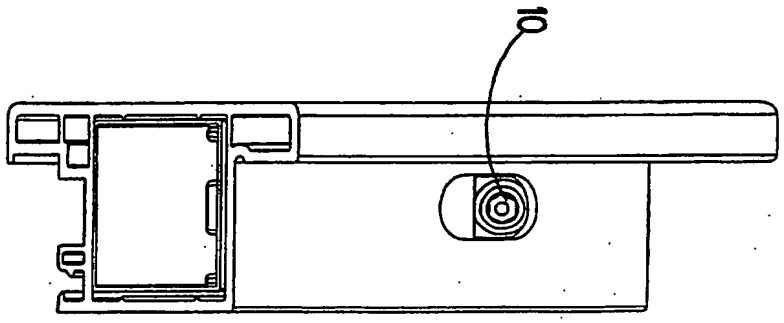

FIG.14